WHAT IS CLAIMED IS:

1. A method of using a position-velocity table to control a dynamic system, the method comprising the steps of:

generating a position variable for the system;

determining a velocity command for the system using the position-velocity table, the determining step determining the velocity command based on the position variable;

shaping the velocity command in order to generate a shaped velocity command; and

controlling the system based on the shaped velocity command.

2. A method according to Claim 1, wherein the method controls a component of the dynamic system, the component comprising a head of a data storage device; and

wherein the controlling step controls the head to move among various tracks of a data storage medium in the data storage device.

3. A method according to Claim 2, wherein the generating step comprises comparing a preset position of the component to a measured position of the component in order to determine the position variable; and

wherein the method further comprises the step of performing inverse shaping on the measured position prior to comparing the measured position to the preset position.

4. A method according to Claim 3, wherein the shaping step and the inverse shaping step reduce unwanted vibrations resulting from movement of the component.

5. A method according to Claim 3, wherein the measured position of the component is determined after the controlling step controls the component; and

wherein the measured position of the component is fed back to the determining step following the controlling step.

6. A method of generating a trajectory for inclusion in a position-velocity table which is used to control a dynamic system, the method comprising the steps of:

generating a trajectory for the dynamic system, the trajectory defining system velocity in terms of system position and one or more additional variables;

storing the trajectory in a position-velocity table having N (N>2) dimensions; and

controlling the dynamic system in accordance with the trajectory stored in the position-velocity table.

7. A method according to Claim 6, wherein the method controls a component of the dynamic system, the component comprising a head of a data storage device; and

wherein the controlling step controls the head to move among various tracks of a data storage medium in the data storage device.

8. A method according to Claim 7, wherein one of the variables comprises a desired movement distance of the component.

9. A method according to Claim 7, wherein the trajectory is generated in real-time based on a partial fraction expansion that defines behavior of the dynamic system.

10. A method of controlling a dynamic system in accordance with a variation in a system variable, the method comprising the steps of:

generating a plurality of trajectories defining system velocity in terms of system position, the plurality of trajectories being generated in accordance with at least one system variable;

storing the plurality of trajectories in a single position-velocity table;

detecting a value of the at least one system variable; and

controlling the dynamic system in accordance with both the detected value of the system variable and the trajectories stored in the position-velocity table.

11. A method according to Claim 10, wherein the position-velocity table comprises a series of trajectories corresponding to various component movement distances; and

wherein the controlling step comprises selecting one of the trajectories from the position-velocity table based on the detected value of the system variable and controlling a component of the dynamic system in accordance with the selected trajectory.

12. A method according to Claim 10, wherein the controlling step comprises generating a function based on the plurality of trajectories and the system variable, determining a single trajectory for the component based on the function, and controlling a component of the dynamic system based on the single trajectory.

13. A method according to Claim 10, wherein the generating step comprises the steps of:

estimating system parameters, the system parameters relating to movement of a component of the dynamic system;

determining whether the system parameters have varied from predetermined system parameters;

modifying the trajectories based on determined system parameter variations; and

storing the modified trajectories in the position-velocity table.

14. A method of generating a trajectory for inclusion in a position-velocity table which is used in controlling a dynamic system, the method comprising the steps of:

generating a trajectory for use in the dynamic system;

storing the trajectory in the position-velocity table; and

controlling the dynamic system in accordance with the trajectory stored in the position-velocity table;

wherein the generating step generates the trajectory in accordance with a technique for reducing unwanted vibrations in the dynamic system.

15. A method according to Claim 14, wherein the method controls a component of the dynamic system, the component comprising a head of a data storage device; and

wherein the controlling step controls the head to move among various tracks of a data storage medium in the data storage device.

16. A method according to Claim 15, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory by taking into account both a system vibration limiting constraint and a system sensitivity constraint.

17. A method according to Claim 16, wherein the system vibration limiting and sensitivity constraints reduce vibration during movement of the component by less than 100%.

18. A method according to Claim 15, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory by taking into account one or more constraints which are a function of a movement distance of the component.

19. A method according to Claim 15, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory by taking into account a system vibration limiting constraint only.

20. A method according to Claim 15, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory based on an input which has been shaped in accordance with a predetermined shaping function.

21. A method according to Claim 20, wherein the input includes both transient portions and a steady state portion; and

wherein only the transient portions of the input have been shaped in accordance with the predetermined shaping function.

22. A method according to Claim 15, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory by filtering a predetermined trajectory using filters having zeros which are substantially near poles of the system.

23. A method according to Claim 15, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory by taking into account at least one of constraints relating to system thermal limits, system current limits, and system duty cycle.

24. A method according to Claim 15, wherein the technique for reducing unwanted movement of the component comprises the steps of:

determining whether a trajectory excites greater than a predetermined level of vibrations in the system; and

applying input shaping to the trajectory in a case that the trajectory excites greater than the predetermined level of vibrations.

25. A method according to Claim 15, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory based on a Posicast input.

26. A method according to Claim 15, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory based on a symmetric input.

27. A method according to Claim 15, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory based on a symmetric constraint that varies as a function of at least one of time and component position.

28. A method according to Claim 15, wherein the technique for reducing unwanted vibrations of the component comprises generating a trajectory in accordance with a voltage which has been controlled by controlling current.

29. A method according to any one of Claims 14 to 28, wherein the generating step comprises:

identifying system parameters in real-time; and

modifying the trajectory in real-time in accordance with the system parameters identified in the identifying step.

30. A data storage device which uses a position-velocity table to control movement of a component of the data storage device, the data storage device comprising:

a memory which stores the position-velocity table and computer-executable process steps; and

a processor which executes the process steps stored in the memory so as (i) to generate a position variable for the component, (ii) to determine a velocity command for the component using the position-

velocity table, the processor determining the velocity command based on the position variable, (iii) to shape the velocity command in order to generate a shaped velocity command, and (iv) to control the component to move based on the shaped velocity command.

31. A data storage device according to Claim 30, wherein the component comprises a head of the data storage device; and

wherein the processor controls the head to move among various tracks of a data recording medium in the data storage device.

32. A data storage device according to Claim 30, wherein, to generate a position variable for the component, the processor compares a preset position of the component to a measured position of the component; and

wherein the processor further performs inverse shaping on the measured position prior to comparing the measured position to the preset position.

33. A data storage device according to Claim 32, wherein the shaping and inverse shaping performed by the processor reduce unwanted vibrations resulting from movement of the component.

34. A data storage device according to Claim 32, wherein the processor determines the measured position of the component after controlling the component; and

wherein the processor uses a previously-measured position of the component to determine the position variable.

35. An apparatus which generates a trajectory for inclusion in a position-velocity table that is used in to control a dynamic system, the apparatus comprising:

a memory which stores computer-executable process steps and a position-velocity table having N (N>2) dimensions; and

a processor which executes the process steps stored in the memory so as (i) to generate a trajectory for the system, the trajectory defining system velocity in terms of system position and one or more additional variables, (ii) to store the trajectory in the position-velocity table, and (iii) to control the system in accordance with the trajectory stored in the position-velocity table.

36. An apparatus according to Claim 35, wherein the apparatus controls a component of the dynamic system, the component comprising a head of a data storage device; and

wherein the processor controls the head to move among various tracks of a data storage medium in the data storage device.

37. An apparatus according to Claim 36, wherein one of the variables comprises a desired movement distance of the component.

38. An apparatus according to Claim 36, wherein the processor generates the trajectory in real-time based on a partial fraction expansion that defines behavior of the dynamic system.

39. An apparatus which controls a dynamic system in accordance with a variation in a system variable, the apparatus comprising:

a memory which stores a position-velocity table and computer-executable process steps; and

a processor which executes the process steps stored in the memory so as (i) generate a plurality of trajectories defining velocity in terms of position, the plurality of trajectories being generated in accordance with at least one system variable, (ii) to store the plurality of trajectories in the position-velocity table, (iii) to detect a value of the at least one system variable, and (iv) to control the dynamic system in accordance with both

the detected value of the system variable and the trajectories stored in the position-velocity table.

40. An apparatus according to Claim 39, wherein the position-velocity table comprises a series of trajectories corresponding to various component movement distances; and

wherein the processor controls a component of the dynamic system by selecting one of the trajectories from the position-velocity table based on the detected value of the system variable and by controlling the component in accordance with the selected trajectory.

41. An apparatus according to Claim 39, wherein the processor controls a component of the dynamic system by generating a function based on the plurality of trajectories and the system variable, by determining a single trajectory for the component based on the function, and by controlling the component based on the single trajectory.

42. An apparatus according to Claim 39, wherein the processor generates the plurality of trajectories by (i) estimating system parameters, the system parameters relating to movement of a component of the dynamic system, (ii) determining whether the system parameters have varied from predetermined system parameters, (iii) modifying the trajectories based on determined system parameter variations, and (iv) storing the modified trajectories in the position-velocity table.

43. An apparatus for generating a trajectory for inclusion in a position-velocity table which is used in controlling a dynamic system, the apparatus comprising:

a memory which stores the position-velocity table and computer-executable process steps; and

a processor which executes the process steps stored in the memory so as (i) to generate a trajectory for the system, (ii) to store the trajectory

in the position-velocity table, and (iii) to control the system in accordance with the trajectory stored in the position-velocity table;

wherein the processor generates the trajectory in accordance with a technique for reducing unwanted vibrations in the system.

44. An apparatus according to Claim 43, wherein the apparatus controls a component of the dynamic system, the component comprising a head of a data storage device; and

wherein the processor controls the head to move to among various tracks of a magnetic disk in the disk drive.

45. An apparatus according to Claim 44, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory by taking into account both a system vibration limiting constraint and a system sensitivity constraint.

46. An apparatus according to Claim 45, wherein the system vibration limiting and sensitivity constraints reduce vibration during movement of the component by less than 100%.

47. An apparatus according to Claim 44, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory by taking into account one or more constraints which are a function of a movement distance of the component.

48. An apparatus according to Claim 45, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory by taking into account a system vibration limiting constraint only.

49. An apparatus according to Claim 44, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory based on an input which has been shaped in accordance with a predetermined shaping function.

50. An apparatus according to Claim 49, wherein the input includes both transient portions and a steady state portion; and

wherein only the transient portions of the input have been shaped in accordance with the predetermined shaping function.

51. An apparatus according to Claim 44, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory by filtering a predetermined trajectory using filters having zeros which are substantially near poles of the system.

52. An apparatus according to Claim 44, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory by taking into account at least one of constraints relating to system thermal limits, system current limits, and system duty cycle.

53. An apparatus according to Claim 44, wherein the technique for reducing unwanted movement of the component comprises the steps of:

determining whether a trajectory excites greater than a predetermined level of vibrations in the system; and

applying input shaping to the trajectory only in a case that the trajectory excites greater than the predetermined level of vibrations.

54. An apparatus according to Claim 44, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory based on a Posicast input.

55. An apparatus according to Claim 44, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory based on a symmetric input.

56. An apparatus according to Claim 44, wherein the technique for reducing unwanted vibrations of the component comprises generating the trajectory based on a symmetric constraint that varies as a function of at least one of time and component position.

57. An apparatus according to Claim 44, wherein the technique for reducing unwanted vibrations of the component comprises generating a trajectory in accordance with a voltage which has been controlled by controlling current.

58. An apparatus according to any one of Claims 43 to 57, wherein the processor generates the trajectory by (i) identifying system parameters in real-time, and (ii) modifying the trajectory in real-time in accordance with the system parameters identified by the processor.

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59. A method of generating a position-velocity table for a dynamic system, the method comprising the steps of:

modeling the dynamic system in terms of partial fraction expansion equations;

integrating the partial fraction expansion equations forward in time so as to generate a trajectory for the dynamic system; and

storing the trajectory for the system in the position-velocity table.

60. A method according to Claim 59, wherein the partial fraction expansion equations which model the dynamic system comprise:

$$Finalpos = \sum_{i=1}^{N} V_i \ A \ \Delta t$$

$$0 = \sum_{i=1}^{N} V_i \ \frac{Ab}{b-a} \ (e^{-a\,(T_{end} - T_i + \Delta t)} - e^{-a\,(T_{end} - T_i)})$$

$$0 = \sum_{i=1}^{N} V_i \ \frac{Aa}{a-b} \ (e^{-b\,(T_{end} - T_i + \Delta t)} - e^{-b\,(T_{end} - T_i)}),$$

where Finalpos is the final position of a component of the dynamic system, T_{end} corresponds to a time at which Finalpos is reached, A, a and b are based on the system parameters, V_i are inputs to the system, T_i are the times at which V_i are input, and) t is a time interval at which V_i are input.

61. An apparatus according to Claim 43, wherein the position-velocity table comprises a non-dimensional position velocity table.